Requested Patent: WO0173973A1

Title:

METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET ;

Abstracted Patent: WO0173973 ;

Publication Date: 2001-10-04 ;

Inventor(s):

LEE YUNG-LYUL; LI ADAM H; PARK DONG-SEEK; PARK JEONG-HOON; VILLASENOR JOHN; TISSERAND MATTHIEU ;

Applicant(s): SAMSUNG ELECTRONICS CO LTD (KR); UNIV CALIFORNIA (US) ;

Application Number: WO2000KR01572 20001230 ;

Priority Number(s): KR20000024209 20000506; US20000192937P 20000329 ;

IPC Classification: H04B7/005 ;

Equivalents: AU2409501, BR0011026, CA2375375, EP1186118 (WO0173973) ;

ABSTRACT:

A wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof are provided. According to the present invention, error resilience can be increased by adding an error protection code and a corruption indication flag to header information on a radio link protocol (RLP) layer when multimedia data such as video data requiring real time or low delay is transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 October 2001 (04.10.2001)

PCT

(10) International Publication Number
WO 01/73973 A1

(51) International Patent Classification[7]: H04B 7/005

(21) International Application Number: PCT/KR00/01572

(22) International Filing Date:
30 December 2000 (30.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/192,937 29 March 2000 (29.03.2000) US
2000/24209 6 May 2000 (06.05.2000) KR

(71) Applicants: **SAMSUNG ELECTRONICS CO., LTD.** [KR/KR]; 416 Maetan-dong, Paldal-gu, Suwon-city, Kyungki-do 442-373 (KR). **THE REGENTS OF THE UNIVERSITY OF CALIFORNIA** [US/US]; 1111 Franklin Street, 12th floor, Oakland, CA 94607-5200 (US).

(72) Inventors: **PARK, Dong-Seek**; Samsung Electronics CO., Ltd., 416 Maetan-dong, Paldal-gu, Suwon-city, Kyungki-do 442-373 (KR). **PARK, Jeong-Hoon**; Samsung Electronics CO., Ltd., 416 Maetan-dong, Paldal-gu, Suwon-city, Kyungki-do 442-373 (KR). **LEE, Yung-Lyul**; Apt. 192, 1-704 Geukdong, Garak-dong, Songpa-gu, Seoul 138-160 (KR). **VILLASENOR, John**; UCLA Engineering, 405 Hilgard Avenue, Los Angeles, CA 90095 (US). **LI, Adam, H.**; UCLA Engineering, 405 Hilgard Avenue, Los Angeles, CA 90095 (US). **TISSERAND, Matthieu**; UCLA Engineering, 405 Hilgard Avenue, Los Angeles, CA 90095 (US).

(74) Agent: **LEE, Young-Pil**; The Cheonghwa Building, 1571-18 Seocho-dong, Seocho-gu, Seoul 137-874 (KR).

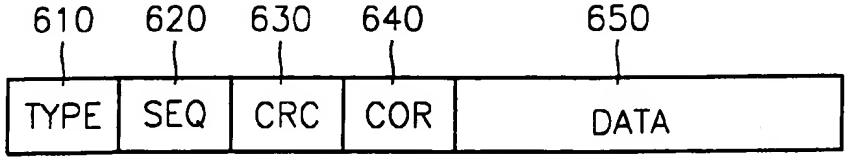
(81) Designated States *(national)*: AU, BR, CA, CN, JP, RU, SG.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

**Published:**
*with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET




(57) Abstract: A wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof are provided. According to the present invention, error resilience can be increased by adding an error protection code and a corruption indication flag to header information on a radio link protocol (RLP) layer when multimedia data such as video data requiring real time or low delay is transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced.

WO 01/73973 A1

# METHOD AND APPARATUS FOR TRANSMITTING AND RECEIVING WIRELESS PACKET

## Technical Field

The present invention relates to a radio transmitting/receiving system, and more particularly, to a wireless packetization apparatus for transmitting/receiving multimedia data including video data in a radio transmitting/receiving system, and a method thereof.

## Background Art

In general, a radio transmitter and a radio receiver employing a phase 1 standard in cdma 2000 are formed of high-level layers as shown in FIG. 1. Codec-related standards such as H.324M. H.323, and T.120 correspond to an application layer. A physical layer performs channel coding, PN spreading, and modulation. A media access control (MAC) layer includes a signaling unit (not shown) and a radio link protocol (hereinafter referred to as RLP) (not shown), and the RLP converts payload on the application layer transmitted through a radio path into an input format on the physical layer. The physical layer among the three layers is mainly realized by hardware, and its flexibility is small when its hardware is determined by a standard. However, flexibility can be given to the application layer considering its network-independent portion.

Referring FIG. 2, one RLP corresponds to each of a number N of applications (application 1, application 2, . . . , and application N). The RLP is connected to a physical layer 240 through a MUX sub-layer 230.

The MUX sub-layer 230 multiplexes a number N of received RLPs adaptively to a protocol data unit (PDU). Here, the multiplex protocol data unit (MUX-PDU) is available in a case where a channel bit error rate is less than $10^{-6}$.

Referring to FIG. 3, a TYPE field 310 denotes a frame type, that is, re-transmitted frame or a new frame, and a SEQ field 320 denotes a frame number or a sequence number, and a DATA field 330 denotes a payload

received from an application layer. Here, a RLP type 3as shown in FIG. 3 is a mode, which even allows data to be re-transmitted, and the length of the DATA field 330 is variable in unit of byte. In this case, the length of the entire RLP frame is fixed. However, when even a part of header portions 310 and 320 of the RLP frame is damaged, it is impossible for a recipient to know the exact length of the DATA field 330, and then, RLP decoding is not possible.

Disclosure of the Invention

To solve the above problems, it is a first object of the present invention to provide a wireless packetization method for increasing error-robustness while reducing overhead so that multimedia data including video data may be suitable in a wireless environment.

It is a second object of the present invention to provide a method for receiving a wireless packet for decoding frame data, which is packetized by the wireless packetization method.

It is a third object of the present invention to provide a wireless packetization apparatus in which the wireless packetization method is implemented.

It is a fourth object of the present invention to provide an apparatus for receiving a wireless packet in which the method for decoding a wireless packet is implemented.

Accordingly, to achieve the first object, there is provided a wireless packetization method in a multimedia transmitting and/or receiving system in a wireless network. The method comprises the steps of: forming a predetermined layer protocol by adding a header to multimedia data which is transmitted through a radio path; and adding an error protection code for protecting an error for the header information, and a corruption indication flag for indicating corruption for the data, to the header of the predetermined layer protocol which is formed in the step.

According to another aspect of the first object, there is provided a wireless packetization method for a wireless link layer protocol in a

multimedia transmitting apparatus in a wireless network. The method comprises the steps of: forming a wireless link layer protocol by adding a header to multimedia data which is transmitted through an application layer; and adding an error protection code for protecting an error for the header information, and a corruption indication flag for indicating corruption for the data, to the header of the wireless link layer protocol which is formed in the step.

In order to achieve the second object, there is provided a method for receiving a wireless packet in a method for decoding data by receiving a packet in which an error protection code for protecting an error for header information and a corruption indication flag for indicating corruption for data are added to a header of a radio link layer protocol. The method comprises the steps of: transmitting a RLP frame in a case where there is no error when a data field is checked by an error protection code on a multiplex (MUX) layer, to a next layer and checking an error of the header information by the error protection code in a case where there is some error; and setting the corruption indication flag and re-sequencing data of the data field in a case when there is no error in a header in the step and resetting the corruption indication flag and discarding the entire frame in a case where there is some error.

In order to achieve the third object, there is provided a wireless packetization apparatus for a wireless link layer protocol in a multimedia transmitting system in a wireless network. The apparatus includes a header information-creating unit for creating header information to which an error protection code for protecting an error for header information relating to multimedia data transmitted through an application layer and a corruption indication flag for indicating corruption for the data are added, and a radio link protocol (RLP) frame-forming unit for forming a radio link frame by multiplexing the header information formed in the header information-creating unit and the data.

In order to achieve the fourth object, there is provided an apparatus for receiving a wireless packet in an apparatus for decoding data by

receiving a packet in which an error protection code for protecting an error for header information and a corruption indication flag for indicating corruption for data are added to a header of a radio link layer protocol. The apparatus includes a means for transmitting a RLP frame in a case where there is no error when a data field is checked by an error protection code on a multiplex (MUX) layer, to a next layer and for checking an error of the header information by the error protection code in a case where there is some error, and a means for setting the corruption indication flag and for re-sequencing data of the data field in a case when there is no error in a header in the step and for resetting the corruption indication flag and for discarding the entire frame in a case where there is some error.

Brief Description of the Drawings

FIG. 1 is a block diagram of a conventional radio transmitter/receiver employing a phase 1 in cdma 2000;

FIG. 2 illustrates relations between RLP and a MUX sub-layer;

FIG. 3 is a format diagram of a frame of MUX-PDU type 3 in CDMA version 2000;

FIG. 4 is a conceptual diagram of RLP framing according to the present invention;

FIG. 5 is a flow chart of RLP framing according to the present invention;

FIG. 6 is a format diagram of a new RLP frame according to FIG. 5; and

FIG. 7 is a flow chart for decoding the RLP frame of FIG. 6.

*Best mode for carrying out the Invention*

Referring to FIG. 4, a header information-creating unit 410 generates header information, which are matched to application data, that is, a frame type field, a sequence number field, an error detection code, and a corruption flag. Here, the corruption flag is indicated as two types of "0" or "1" indicating data corruption. A RLP frame-forming unit 420 forms a RLP

frame by multiplexing header information and data, which are formed in the header information-creating unit 410.

Referring to FIG. 5, a RLP layer receives data from an application layer (step 510).

Next, the RLP layer creates a TYPE field indicating a RLP type and a sequence number field indicating a sequence number (step 520).

Next, the RLP layer creates a cyclic redundancy code (CRC) for detecting and correcting an error by checksumming bits of the TYPE and sequence number fields (step 530).

Next, a corruption flag field indicating corruption of the data field is added to the RLP layer (step 540).

Next, the RLP layer forms a RLP frame of data and header information including the TYPE field, the sequence number field, the CRC field, and the corruption flag field, which are created in the steps 510 to 540 (step 550).

A RLP frame shown in FIG. 6 is formed of a header portion comprising a TYPE field 610, a sequence number (SEQ) field 620, a CRC field 630, and a corruption flag (COR) field 640, and a data field 650. The CRC field 630 and the COR filed 640 are added to the TYPE field 310 and the SEQ field 320, which are contained in the conventional header (see FIG. 3).

Here, the TYPE field 610 defines a frame type of a RLP. For example, when the TYPE field 610 is comprised of 2 bits, "10" is a new frame, and "11" is a re-transmitted frame. The SEQ field 620 denotes a sequence number and is comprised of 8 bits. The CRC field 630 is a 4-bit CRC for detecting and correcting an error of the TYPE field 610 and the SEQ field 620. Also, people skilled in the art can properly select a polynomial operator p(x) for the CRC of a specific field. For example, in case of 4-bit CRC, the polynomial operator $p(x) = x^4 + x^2 + x + 1$ can be used. The COR field 640 is a flag indicating corruption of data and set by indication on a lower layer than a RLP layer. For example, when the COR field 640 is "0", there is no error in the data, and when the COR field 640 is

"1", there is some error in the data.

In this way, a preferred embodiment when decoding the encoded RLP frame on the RLP layer of a recipient will be described with reference to FIG. 7.

First, a RLP frame is decoded by receiving a packet on the RLP layer (step 710).

Next, the RLP layer checks data by an error detection code (CRC) of the data field 650, which is formed in MUX-PDU on a MUX sub-layer (steps 712 and 714). Here, the RLP layer transmits the RLP frame to an application layer after setting the COR field 640 to "0" in a case where there is no error in the data field 650 (step 724).

However, in a case where some error is detected in the data field 650, the RLP layer checks an error of the TYPE field 610 and the SEQ field 620 by the error detection code (CRC), which is contained in the header (steps 716 and 718). Here, the RLP layer sets the COR field 640 to "1", which corresponds to data corruption (step 720) in a case where any error is not detected in the header, and in a case where any error is detected in the header, the RLP layer sets the COR field 640 to "0" (step 726). Here, when the COR field 640 is "1", the sequence number of the SEQ field 620 is increased by 1, and the data of the data field 650 are stored in a re-sequencing buffer (not shown) (step 722), and when the COR field 640 is "0", the sequence number SEQ is unknown, and then, the entire RLP frame is discarded (step 728).

In this way, the recipient error-protects header information such as the TYPE field 610 and the SEQ field 620 by the error detection code (CRC) 630 when decoding the encoded RLP frame, and it is known by the COR field 640 whether there is some error in the data or not.

Also, corruption of data is determined through the COR field 640 when decoding, and then, error resilience can be increased.

The above encoding and decoding methods can be embodied in a computer program. Codes and code segments encompassing the program can be easily inferred to by a skilled computer programmer in the art. Also,

the program can be realized in media used in a computer and in a common digital computer for operating the program. The program can be stored in computer readable media. The media can include magnetic media such as a floppy disk or a hard disk and optical media such as a CD-ROM or a digital video disc(DVD). Also, the program can be transmitted by carrier waves such as the Internet.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

Industrial Applicability

As described above, error resilience can be increased by adding an error protection code and a corruption indication flag to header information on a radio link protocol (RLP) layer when multimedia data such as video data requiring real time or low delay is transmitted and received in a wireless environment, and a packet drop rate can be thereby reduced.

What is claimed is:

1. A wireless packetization method in a multimedia transmitting and/or receiving system in a wireless network, comprising the steps of:

forming a predetermined layer protocol by adding a header to multimedia data which is transmitted through a radio path; and

adding an error protection code for protecting an error for the header information, and a corruption indication flag for indicating corruption for the data, to the header of the predetermined layer protocol which is formed in the step.

2. The wireless packetization method according to claim 1, wherein the corruption indication flag is set by a result in which an error of the error protection code for the header information is checked.

3. A wireless packetization method for a wireless link layer protocol in a multimedia transmitting apparatus in a wireless network, comprising the steps of:

forming a wireless link layer protocol by adding a header to multimedia data which is transmitted through an application layer; and

adding an error protection code for protecting an error for the header information, and a corruption indication flag for indicating corruption for the data, to the header of the wireless link layer protocol which is formed in the step.

4. The wireless packetization method according to claim 3, wherein the error protection code error-protects at least one between radio link protocol (RLP) type information and sequence number information, which are set to the header of the wireless link layer protocol.

5. The wireless packetization method according to claim 3, wherein the corruption indication flag indicates a data error received on a lower layer than the wireless link layer protocol.

6. The method for transmitting a wireless packet according to claim 3, wherein the corruption indication flag indicates an error of data contained in multiplex-protocol data unit (MUX-PDU) on a multiplex (MUX) sub-layer.

7. A method for receiving a wireless packet in a method for decoding data by receiving a packet in which an error protection code for protecting an error for header information and a corruption indication flag for indicating corruption for data are added to a header of a radio link layer protocol, comprising the steps of:

transmitting a RLP frame in a case where there is no error when a data field is checked by an error protection code on a multiplex (MUX) layer, to a next layer and checking an error of the header information by the error protection code in a case where there is some error; and

setting the corruption indication flag and re-sequencing data of the data field in a case when there is no error in a header in the step and resetting the corruption indication flag and discarding the entire frame in a case where there is some error.

8. The method for receiving a wireless packet according to claim 7, wherein the error protection code on the MUX layer is a code for checking the error of the data field in multiplex-protocol data unit (MUX-PDU).

9. A wireless packetization apparatus for a wireless link layer protocol in a multimedia transmitting system in a wireless network, comprising:

a header information-creating unit for creating header information to which an error protection code for protecting an error for header information relating to multimedia data transmitted through an application layer and a corruption indication flag for indicating corruption for the data are added; and

a radio link protocol (RLP) frame-forming unit for forming a radio link frame by multiplexing the header information formed in the header information-creating unit and the data and the data.

10. An apparatus for receiving a wireless packet in an apparatus for decoding data by receiving a packet in which an error protection code for protecting an error for header information and a corruption indication flag for indicating corruption for data are added to a header of a radio link layer protocol, comprising:

a means for transmitting a RLP frame in a case where there is no error when a data field is checked by an error protection code on a multiplex (MUX) layer, to a next layer and for checking an error of the header information by the error protection code in a case where there is some error; and

a means for setting the corruption indication flag and for re-sequencing data of the data field in a case when there is no error in a header in the step and for resetting the corruption indication flag and for discarding the entire frame in a case where there is some error.

FIG. 1

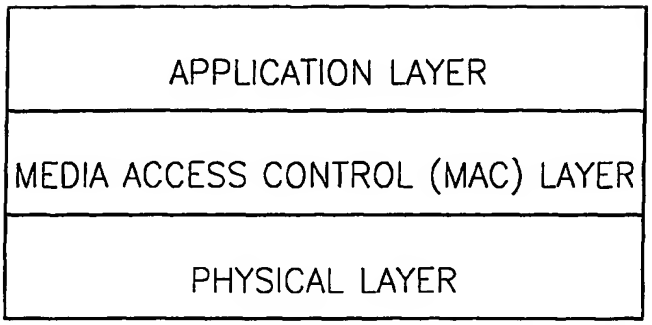



FIG. 2

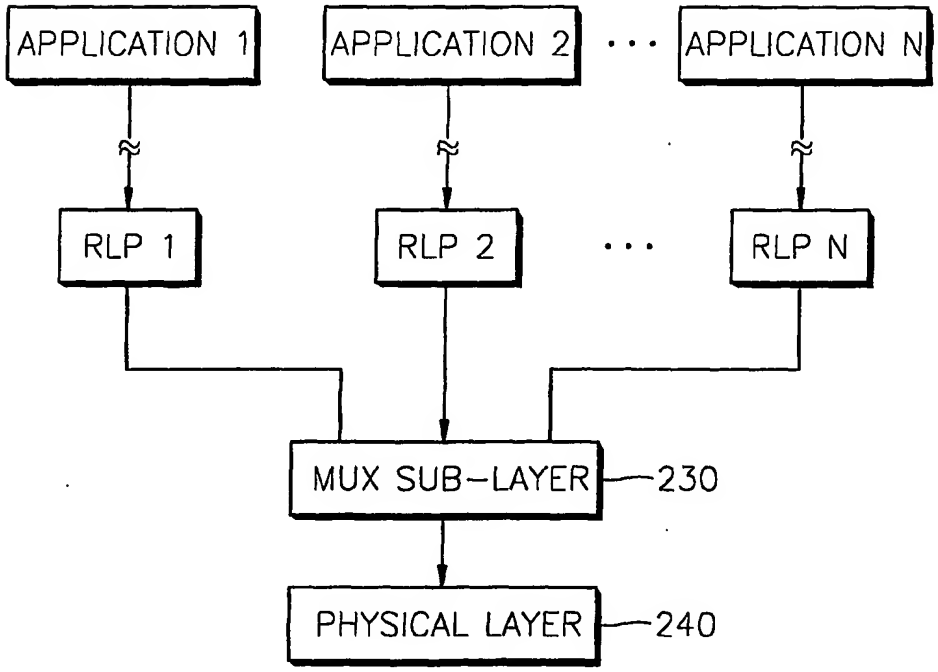



FIG. 3

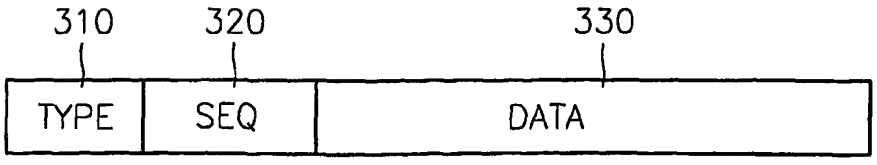


FIG. 4

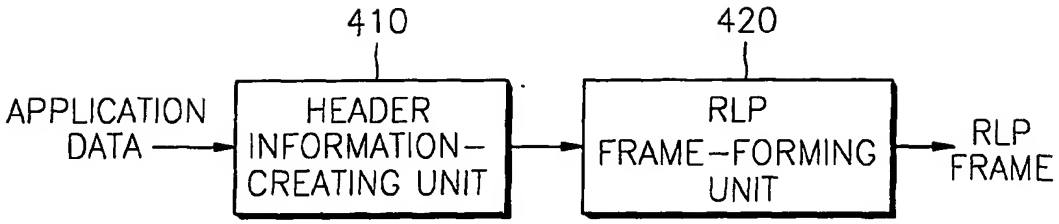

410
420
APPLICATION DATA
HEADER INFORMATION-CREATING UNIT
RLP FRAME-FORMING UNIT
RLP FRAME

FIG. 5

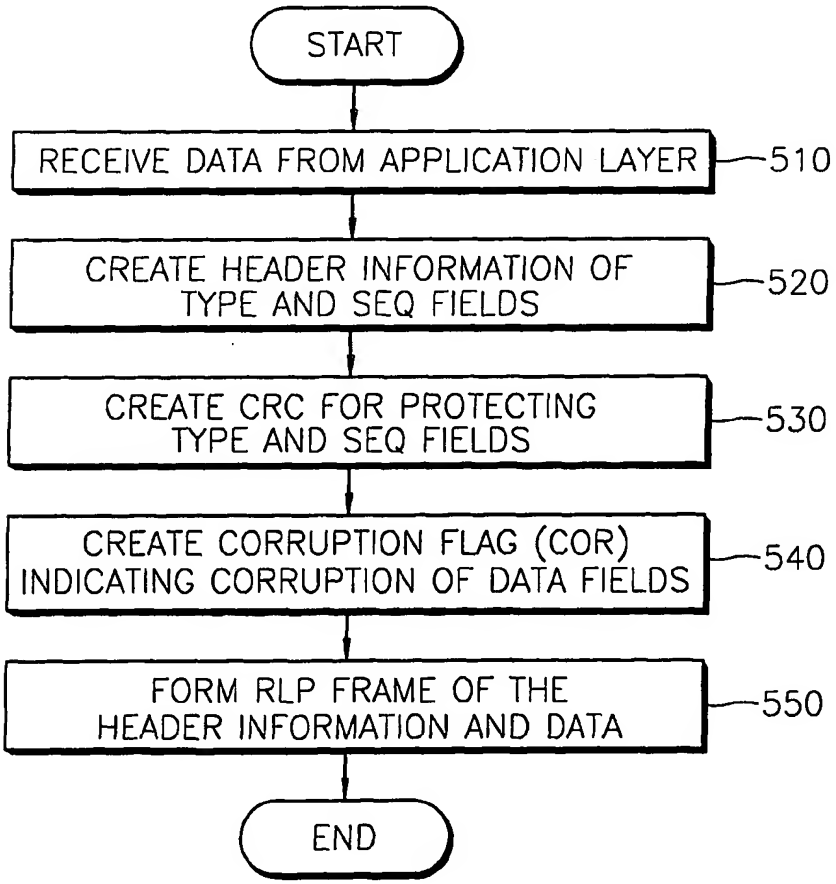

START
RECEIVE DATA FROM APPLICATION LAYER
510
CREATE HEADER INFORMATION OF TYPE AND SEQ FIELDS
520
CREATE CRC FOR PROTECTING TYPE AND SEQ FIELDS
530
CREATE CORRUPTION FLAG (COR) INDICATING CORRUPTION OF DATA FIELDS
540
FORM RLP FRAME OF THE HEADER INFORMATION AND DATA
550
END

FIG. 6

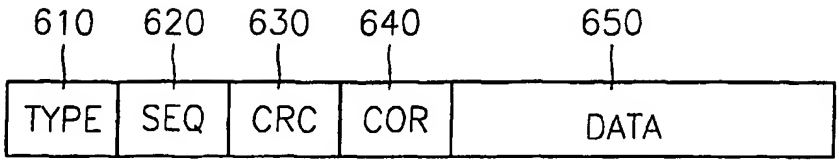
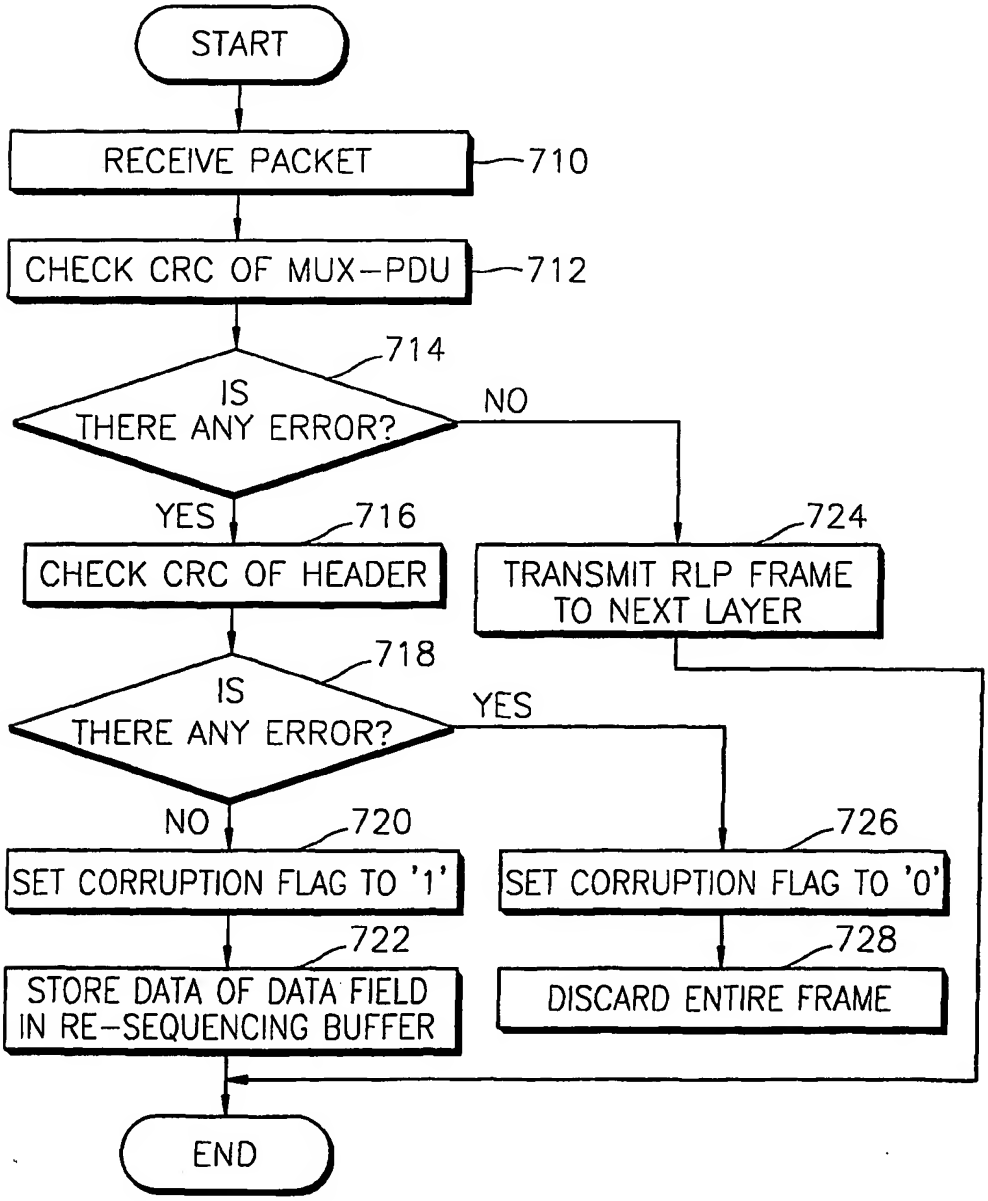

610
620
630
640
650
TYPE
SEQ
CRC
COR
DATA

FIG. 7


START
RECEIVE PACKET
710
CHECK CRC OF MUX-PDU
712
714
IS THERE ANY ERROR?
NO
YES
716
CHECK CRC OF HEADER
724
TRANSMIT RLP FRAME TO NEXT LAYER
718
IS THERE ANY ERROR?
YES
NO
720
SET CORRUPTION FLAG TO '1'
726
SET CORRUPTION FLAG TO '0'
722
STORE DATA OF DATA FIELD IN RE-SEQUENCING BUFFER
728
DISCARD ENTIRE FRAME
END

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/01572

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04B 7/005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC : H04B

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Korean Patents and Applications for Inventions since 1975
Korean Utility models and Applications for Utility models since 1975

Electronic data base consulted during the internnational search (name of data base and, where practicable, search trerms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO 9921296 :<br>abstract, figures and claim 1, 6 | 1, 7, 8, 9, 10 |
| Y | KR 10-1996-33096 : (MURAKAMI)<br>(Date of publication : Sep,. 17,. 1996)<br>abstract, figures and claim 1, 4 | 1, 7, 8, 9, 10 |
| Y | WO 0004677<br>abstract, figures and claim 1 | 4, 7, 10 |
| A | US 6104757<br>abstract, figures and detail description | 1 - 10 |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevence

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 18 APRIL 2001 (18.04.2001) | 18 APRIL 2001 (18.04.2001) |

| Name and mailing address of the ISA/KR | Authorized officer |
|---|---|
| Korean Intellectual Property Office<br>Government Complex-Taejon, Dunsan-dong, So-ku, Taejon<br>Metropolitan City 302-701, Republic of Korea | LEE, Saang Woong |
| Facsimile No. 82-42-472-7140 | Telephone No. 82-42-481-5714 |

Form PCT/ISA/210 (second sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR00/01572

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 99/21296 | 04. 29. 99 | NONE | |
| KR 10-1996-33096 | 09. 17. 96 | JP 95-21699 | 02. 09. 95. |
| WO 00/04677 | 01. 27. 00 | NONE | |
| US 6104757 | 08. 15. 00 | NONE | |